

BS ISO 1953:2015



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Hard coal — Size analysis by sieving

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National foreword

This British Standard is the UK implementation of ISO 1953:2015. It supersedes BS 1016-109:1995 which is withdrawn.

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Hard coal — Size analysis by sieving

Houille — Analyse granulométrique par tamisage



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 27, *Solid mineral fuels*, Subcommittee SC 1, *Coal preparation: Terminology and performance*.

This third edition cancels and replaces the second edition (ISO 1953:1994), of which it constitutes a minor revision.

Introduction

Size analysis involves the separation of a sample of coal into size fractions having defined limits. In the methods described in this International Standard the results are expressed in terms of the percentage mass of coal remaining on sieves of different aperture sizes. This information can be of use in a number of applications, including the following: assessing the yields of products from run-of-mine coals; providing design data for coal preparation plants; checking that products from screening plants are within the required limits; assessing the performance of coal-crushing plants; and selecting coals for particular processes and equipment.

Hard coal — Size analysis by sieving

1 Scope

This International Standard specifies reference methods for the size analysis of coal by manual sieving (wet or dry), using test sieves of aperture sizes between 125 mm and 45 μm . A guide to sampling is given in [Annex A](#).

This International Standard is applicable to all hard coals. It is not applicable to coke or other manufactured fuels.

In the case of pulverized coal which has been ground so that a high proportion passes through the test sieve of smallest aperture size, the methods described in this International Standard will determine only the percentage oversize.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1213-1, *Solid mineral fuels — Vocabulary — Part 1: Terms relating to coal preparation*

ISO 1213-2, *Solid mineral fuels — Vocabulary — Part 2: Terms relating to sampling, testing and analysis*

ISO 13909 (all parts), *Hard coal and coke — Mechanical sampling*

ISO 18283, *Hard coal and coke — Manual sampling*

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

ISO 3310-2, *Test sieves — Technical requirements and testing — Part 2: Test sieves of perforated metal plate*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1213-1 and ISO 1213-2 apply.

4 Apparatus

4.1 For all methods

4.1.1 Test sieves, exclusively round-hole or exclusively square-hole, complying with ISO 3310-1 or ISO 3310-2, as appropriate.

The recommended series of test sieves for general purposes is 125 mm, 90 mm, 75 mm, 63 mm, 50 mm, 45 mm, 31,5 mm, 22,4 mm, 16 mm, 11,2 mm, 8 mm, 5,6 mm, 4 mm, 2 mm and 1 mm nominal aperture sizes, square-hole, or the same sizes of round-hole sieves. If this series is inadequate for the sizing of graded coals, sieves from the supplementary sizes 100 mm, 80 mm, 40 mm, 25 mm, 20 mm, 12,5 mm, 10 mm and 6,3 mm may be included. For samples greater than 125 mm, single square-hole gauges of the required dimensions may be used for the larger pieces. Test sieves of nominal aperture size 4 mm and less should be of metal wire cloth; the recommended series of nominal aperture sizes is 4 mm, 2,8 mm, 2 mm, 1,4 mm, 1 mm, 710 μm , 500 μm , 355 μm , 250 μm , 180 μm , 125 μm , 90 μm , 63 μm and 45 μm .

When a complete size analysis is required, it is preferable, subject to the range of sieve aperture sizes available, that the mass of coal in any size fraction does not exceed 30 % of the total mass of sample being sieved. The largest aperture size sieve should be that on which not more than 5 % mass fraction of the sample is retained and the smallest aperture size sieve should be that through which not more than 5 % mass fraction of the sample passes.

It is important to check the sieves from time to time, by the methods described in ISO 3310-1 and ISO 3310-2, to ensure that the aperture dimensions are within the specified tolerances. Worn or damaged sieves can give rise to serious errors in size analysis and should be discarded.

4.1.2 Receivers, for collecting material passing through the sieves.

4.1.3 Weighing scale, capable of measuring the mass of the sample to be sieved to the nearest 0,1 %.

4.1.4 Trays, smooth, of non-corrodible material, of at least 400 mm × 400 mm, depending on the mass of sample and number of analysis required.

4.1.5 Watch- or clock-glasses.

4.2 For dry sieving

4.2.1 Lids, to fit the test sieves.

4.2.2 Flat brush, for cleaning the sieves and for brushing dust from the trays.

4.2.3 Hardwood block, about 150 mm long with a 10 mm × 10 mm cross-section, for tapping the sieves.

4.2.4 Shovel or scoop.

4.2.5 Vibratory sieve shaker for mechanical sieving.

4.3 For wet sieving

4.3.1 Pressure filter.

4.3.2 Buchner funnel and Buchner flask.

4.3.3 Filter paper.

4.3.4 Oven, capable of being controlled to ± 5 °C in the range 30 °C to 110 °C.

5 Sampling of test sample

The sample shall be taken in accordance with ISO 13909 or ISO 18283, subject to the following provision:

a) the number of increments and the increment masses, for both manual and mechanical sampling, should comply with the requirements of ISO 13909 or ISO 18283.

or

b) the minimum mass of the gross sample should comply with [Table 1](#).

Table 1 — Minimum mass of sample for size analysis

Nominal top size of coal mm	Minimum mass for a precision of 1 % kg	Minimum mass for a precision of 2 % kg
300	54 000	13 500
200	16 000	4 000
150	6 750	1 700
125	4 000	1 000
90	1 500	400
75	950	250
63	500	125
50	280	70
45	200	50
38	130	30
31,5	65	15
22,4	25	6
16,0	8	2
11,2	3	0,70
10,0	2	0,50
8,0	1	0,25
5,6	0,50	0,25
4,0	0,25	0,25
2,8	0,25	0,25
2,0	0,25	0,25
1,0	0,25	0,25
< 0,5	0,25	0,25

Preparation of test sample

5.1 General

Drying is necessary if the coal is wet and dry sieving is to be performed. The gross sample may be divided if its mass greatly exceeds the value given in [Table 1](#). If the gross sample is to be dried and divided, the division shall be carried out first whenever practicable. If no preparation is necessary, the test sample is the gross sample.

5.2 Drying

Air-dry the sample either at ambient temperature or at an elevated temperature not exceeding 40 °C. Cool, if necessary, and allow the moisture content to come to equilibrium with the laboratory atmosphere.

If caking or swelling tests are to be carried out subsequently on the sample, the drying temperature should not exceed 40 °C.

5.3 Division (other than wet coal of nominal top size less than 4 mm)

Divide the sample by means of a suitable mechanical sample divider or riffle avoiding size degradation and loss of dust. For sample that contains larger pieces of particle size greater than say 50 mm, where a suitable mechanical sample divider or riffle is not available, use either the flattened heap method,

the strip mixing and splitting method described in ISO 13909-4 and ISO 18283. Weigh all the coal not included as part of the test sample and retain it until all analyses and calculations are complete.

5.4 Division of wet coal of nominal top size less than 4 mm

Spread the gross sample on a clean flat surface, form into a cake 15 mm to 25 mm thick and extract a 2 kg sample by taking not less than 50 increments, evenly spread over the cake, using an appropriate sampling scoop and bump plate. If further division is necessary, air-dry the divided sample first, as described in [6.2](#) and then proceed as described in [6.3](#).

6 Procedure

6.1 General

The analysis shall be carried out by dry sieving ([7.2](#)) or by wet sieving ([7.3](#)).

In general, dry sieving is suitable for most types of coal but wet sieving should be used if particles tend to agglomerate.

NOTE 1 A combination of wet sieving (to remove fine material) and dry sieving can be appropriate and an example is given in [Annex B](#).

NOTE 2 When sieving coals, wet sieving may produce different results compared to dry sieving because the coals may contain percentages of clay and/or shales which may be soluble in water.

The range of sieves used will depend on the type of coal and the purpose of the test. For example, a complete size analysis may be required for a run-of-mine coal or, in the simplest case, the amount of undersize in a graded product may be required. If the results are to be presented graphically, the range of sieves should comprise at least five different aperture sizes.

During sieving it may be convenient either to weigh separately each container with its size fraction and to subtract the mass of the empty container or to weigh one container with the fraction corresponding to the largest aperture size and to add successively all the other fractions, noting the cumulative mass after each addition. The first technique is preferred for samples having a maximum particle size of 4 mm, so that the end point of sieving may be checked. The second technique is normally used for samples containing pieces having a particle size greater than 4 mm. However, if a detailed analysis of the individual size fractions is required, it is essential to use the first technique.

A preliminary sieving on the smallest aperture size sieve is recommended when the sample contains a large proportion of very fine material.

6.2 Dry sieving

6.2.1 Sample of maximum particle size greater than 22,4 mm

The following procedure applies:

- a) Weigh the sample to be sized to the nearest 0,1 % of the mass of the sample.
- b) Position the 22,4 mm aperture size sieve ([4.1.1](#)) over an empty receiver ([4.1.2](#)) so that the free fall of coal passing through the sieve into the receiver does not exceed 150 mm.
- c) Place the coal on the sieve and move the coal by hand. Hand place each piece of coal in turn and if in some position and without forcing, it passes through the sieve opening, it is designated as passing 22,4 mm. Alternatively a mechanical sieve shaker can be used to assist this process.
- d) Re-sieve the oversize by hand placing from the 22,4 mm aperture size sieve, on the larger aperture size sieves in the set ([4.1.1](#)), starting with the largest aperture size and working down to the

smallest. Collect each size fraction in a weighed empty receiver and reweigh to obtain the mass of each individual fraction.

- e) Sieve the undersize from the 22,4 mm aperture size sieve as described in 7.2.2 or 7.2.3.

NOTE "Hand placing" refers to the operation defined in ISO 1213-2.

6.2.2 Sample of maximum particle size between 4 mm and 22,4 mm—manual method

The following procedure applies:

- a) Weigh the sample to the nearest 0,1 % of the mass of the sample.
- b) Position the largest aperture size sieve in the set (4.1.1) over an empty receiver (4.1.2). Move the sieve horizontally to and fro, with the displacement not exceeding 100 mm in either direction, so as to cause the pieces of coal to tumble or roll on the sieve.
- c) Continue the sieving motion until eight movements in each direction (a total of 16 movements) have taken place after the last undersize piece passes through the sieve. Avoid any impact when stopping the motion.
- d) Place the coal remaining on the sieve in a weighed receiver and reweigh to obtain the mass of the size fraction.
- e) Resieve the undersize by repeating the above process for each sieve down to and including the 4 mm aperture size sieve. If analysis of the undersize from the 4 mm aperture size sieve is required, proceed as described in 7.2.3.

NOTE When using square-hole sieves, the sides of the holes should be parallel to the direction of the sieving motion.

6.2.3 Sample of maximum particle size less than 4 mm—manual method

The following procedure applies:

- a) Weigh the sample to the nearest 0,1 % of the mass of the sample.
- b) Place the smallest aperture size sieve in the set (4.1.1) on a receiver (4.1.2), brush the sample onto the sieve, fit the lid (4.2.1) and sieve continuously for 5 min, as described in Item c) below, to remove the undersize. If the sample is large, sieve it as separate portions so that not more than 75 % of the area of the sieve is covered at the end of each sieving operation.
- c) Hold the receiver, fitted with the sieve and its lid, in the left hand so that the surface of the sieve is inclined downwards towards the left at an angle of about 30° to the horizontal. Tap the higher side of the sieve frame six to eight times with the hardwood block (4.2.3). While maintaining the inclination of the sieve, shake the assembly to and fro several times, also rotating it in the plane of the sieving surface through an angle of approximately 60°.
- d) Continue the operations of tapping and shaking alternately for 5 min.
- e) At the end of the 5 min sieving period allow the suspended dust to settle for 2 min, carefully remove the lid and lift the sieve from the receiver. Invert the sieve over a tray (4.1.4) tap the side of the frame with the hardwood block and carefully brush the uppermost surface of the inverted sieve with the flat brush (4.2.2). Turn the sieve the right way up and add any loose particles dislodged during brushing to the oversize on the tray.
- f) Invert the receiver over a second tray (4.1.4) tap the receiver with the hardwood block and brush out any adherent dust.
- g) If fine dust is still visible in the oversize, replace the sieve on the receiver, transfer the oversize from the first tray to the sieve, replace the lid and re-sieve for a further 5 min. Separate the sieve

and the receiver and again clean the sieve. Add the dust to the material which passed through the sieve during the first 5 min period.

- h) Assemble the appropriate sieves (4.1.1) in a nest, in descending order of aperture size, and fit a receiver (4.1.2). Place the sample on the top sieve. Shake the nest of sieves for a period of 5 min.
- i) At the end of the 5 min period clean each sieve in turn, starting with the smallest aperture size sieve, by inverting it over a tray (4.1.4), tapping the side of the frame with the hardwood block (4.2.3) and carefully brushing the uppermost surface of the inverted sieve with the flat brush (4.2.2). Turn the sieve the right way up and add any loose particles dislodged during the brushing to the oversize on the tray. Return the sieve to the nest and transfer the material on the tray back to the sieve.
- j) Repeat the process described in above Item h) and i) twice, but after the final cleaning of the sieves transfer the material from the trays to the watch- or clock-glasses (4.1.5) and determine the mass of each size fraction. Add the undersize obtained from the initial separation to that from the final sieving before weighing.
- k) After weighing, return each individual size fraction to the corresponding sieve, repeat the sieving cycle described in Item h) and i) and then reweigh each size fraction as described in. Continue this process until the difference between the two weighings for any size fraction, after consecutive sieving cycles, does not exceed 0,2 % of the total mass of coal being sieved.

6.2.4 Sample of maximum particle size between 4 mm and 22,4 mm; minus 4 mm—mechanical method

The following procedure applies:

- a) Weigh the sample to be sized to the nearest 0,1 % of the mass of the sample.
- b) Assemble the appropriate sieves (4.1.1) in a nest, in descending order of aperture size, and fit a receiver (4.1.2). Place the sample on the top sieve and fix a sieve lid. Shake the nest of sieves mechanically for a period of 5 min.
- c) At the end of the 5 min period clean the underside of each sieve in turn with a flat brush, and carefully add any loose particles dislodged during the brushing to the oversize of the immediate sieve below in the nest. Return all the sieves to the nest.
- d) Repeat the process described in Item b) and c) twice, then after the final cleaning of the sieves transfer the material from the sieves and determine the mass of each size fraction. After weighing, return each individual size fraction to the corresponding sieve.
- e) Repeat the sieving cycle described in Item b) and c), and then reweigh each size fraction as described in Item d). Continue this process until the difference between the two weighing's for any size fraction, after consecutive mechanical sieving cycles, does not exceed 0,2 % of the total mass of coal being sieved.

6.3 Wet sieving

The following procedure applies:

- a) Support the largest aperture size sieve in the set (4.1.1) over a receiver (4.1.2) transfer to it about 30 g of the sample and thoroughly wash this portion with a jet of water. Inspect the portion for the presence of aggregated particles and, if these are detected, spray vigorously to effect their breakdown but take care not to overspray, thus causing the disintegration of shale. Add the remainder of the sample to the sieve in approximately 30 g increments, washing the undersize in each portion through into the receiver. Check whether all the fines have been washed through the sieve by collecting some of the washings in a second receiver and examining them closely. If any solids are present, add them to the first receiver and continue the washings until all the fines have been washed through.

- b) Place the sieve and its contents on a tray (4.1.4) and dry as described in 6.2. When dry, tap the sieve two or three times and transfer any material which collects on the tray to the next sieve (with a smaller aperture size) in the set. Brush out both the top and bottom of the first sieve, collecting the oversize on a tared watch- or clock-glass (4.1.5). Reweigh the watch- or clock-glass to obtain the mass of the size fraction.
- c) Support the next sieve in the set over another receiver and pour the contents of the first receiver onto it. Wash any solids remaining in the first receiver onto the sieve, using a jet of water. Continue washing the material on the sieve until all the fines appear to have been washed through. Check whether this is so, as described in Item a), then proceed as described in Item b).
- d) Repeat this process with each of the remaining sieves in turn.
- e) Should the quantity of water in the washings become excessive, allow the solids to settle and decant a portion of the water. Examine the decanted water to ensure that it contains no solid material before discarding it.
- f) Add a flocculating agent to the final washings and allow the solids to settle. Decant and discard as much of the water as possible and filter through a weighed filter paper (4.3.3) using the Buchner funnel (4.3.1) into the Buchner flask (4.3.2). Dry the filter paper and its contents to constant mass in the oven (4.3.4) controlled at a temperature of 105 °C to 110 °C. Subtract the original mass of the filter paper to obtain the mass of the fine material.

NOTE 1 When the total mass of the sample is known, this determination of the undersize serves as a useful check on the efficiency of the sieving and is, therefore, to be carried out whenever possible (see also 7.1).

NOTE 2 If froth flotation is to be carried out after sizing, the use of flocculating agent is not advisable.

7 Expression of results

7.1 Calculation

Calculation shall be done as follows:

- a) The mass of the size fraction retained on each of the different sieves as a percentage of the total mass of the test sample.
- b) Record the percentages, to the nearest 0,1 %, both fractionally and cumulatively. In most cases it will be most convenient to commence with the fraction of largest size but for a sample for which there is particular interest in the amount passing through the sieves, it may be preferred to start with the fraction of smallest size. If the analysis has been performed on a number of replicate samples, calculate the mean percentage of each size fraction.
- c) Adjust the mass of the smallest size fraction to take account of any loss or gain in the total mass of the test sample after sieving. If, however, in any test the loss or gain in mass exceeds 1 % of the total mass of the test sample, reject the results of that test.
- d) If, during the course of a size analysis, the mass of undersize is reduced by sample division, calculate the mass of each of the subsequent fractions as a percentage of the total mass of undersize at the time of division. An example of the calculation of a size analysis involving sample division is given in Table 2 and the sieving procedure is shown schematically in Figure 1.
- e) If replicate sampling of an isolated consignment has been carried out, calculate the precision achieved in accordance with ISO 13909-7.

7.2 Graphical presentation

The presentation of fractional size analyses in graphical form presents difficulties in interpretation, in that the size range of each fraction is seldom uniform. If graphical presentation is required, it

is recommended that the cumulative percentage of material remaining on each sieve is plotted, as ordinate, against sieve aperture size, as abscissa.

A Rosin-Rammler plot should be used whenever possible. The ordinate for a Rosin-Rammler plot is $\lg(100 - R)$, where R is the cumulative percentage of material remaining on each sieve, and the abscissa is the logarithm to base 10 of the sieve aperture size. An example of a Rosin-Rammler Plot, using the data in [Table 2](#), is given in [Figure 2](#).

8 Test report

The test report shall include the following information:

- a) the identification and mass of the sample;
- b) a reference to this International Standard;
- c) details of any sample preparation carried out;
- d) details of the test sieves used including round or square hole references;
- e) whether dry sieving or wet sieving was carried out;
- f) the percentage mass, or the mean percentage mass, in each size fraction;
- g) if replicate sampling of an isolated consignment has been carried out, the precision achieved;
- h) any operation not included in this International Standard, or regarded as optional;
- i) the date of test.

Table 2 — Example of the calculation of a size analysis involving sample division

Sieve aperture size mm	Initial sample		First sample division		Second sample division		Third sample division		Size analysis				
	Mass kg	% of test sample	Mass kg	% of sub-sample (1)	% of test sample (2)	Mass g	% of sub-sample (3)	% of test sample (4)	Mass g	% of sub-sample (5)	% of test sample (6)	Fractional %	Cumulative oversize %
63	19,5	3,1	8,0	8,3	7,6	561,7	21,8	10,5	88,7	32,5	6,6	3,1	3,1
45	32,1	5,1	13,1	13,6	12,5	545,6	21,2	10,2	56,4	20,7	4,2	5,1	8,2
31,5			10,8	11,2	10,3	379,8	14,8	7,1	41,7	15,3	3,1	7,6	15,8
22,4			14,0	14,5	13,3				34,9	12,8	2,6	12,5	28,3
16												10,3	38,6
11,2												13,3	51,9
8												10,5	62,4
5,6												10,2	72,6
4												7,1	79,7
2,8												6,6	86,3
2												4,2	90,5
1,4												3,1	93,6
1												2,6	96,2
< 1												3,8	100,0
Total retained on sieves (A)	51,6	8,2	45,9	47,7	43,8	1 487,1	57,8	27,8	221,7	81,3	16,5		
Passing finest sieve (B)	576,4	91,5	50,2	52,1	47,8	1 079,7	42,0	20,2	50,0	18,3	3,7		
Sample used (C)	629,7	100,0	96,3	100,0	91,8	2 573,0	100,0	48,1	272,8	100,0	20,3		
Loss (D)	1,7	0,3	0,2	0,2	0,2	6,2	0,2	0,1	1,1	0,4	0,1		
Passing + loss (B + D)		91,8			48,1			20,3			3,8		
Reduction factor $F = (B + D)/100$		$F_1 = 0,918$		$F_2 = 0,481$		$F_3 = 0,203$							

NOTE The data in columns (2), (4) and (6) are obtained by multiplying the corresponding data in columns (1), (3) and (5), respectively, by the reduction factors F_1 , F_2 and F_3 .

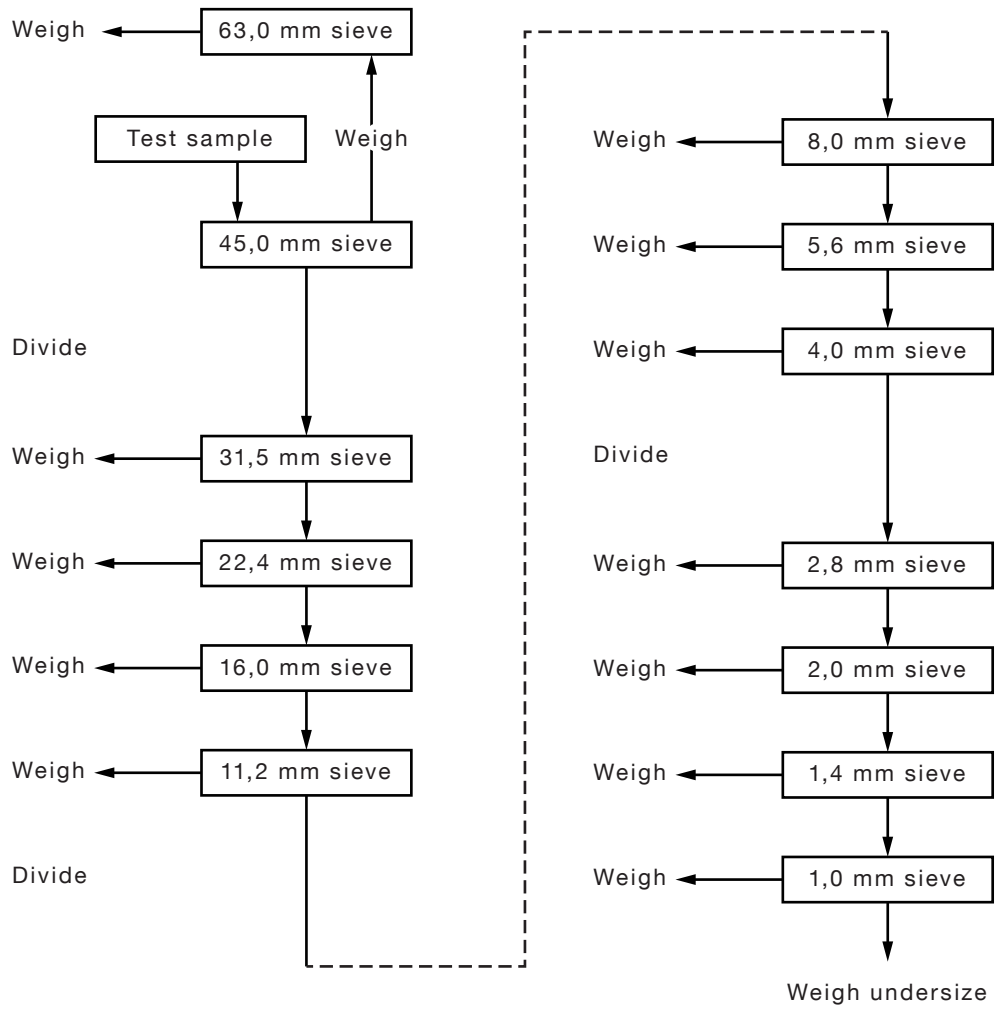


Figure 1 — Schematic diagram of a sieving procedure

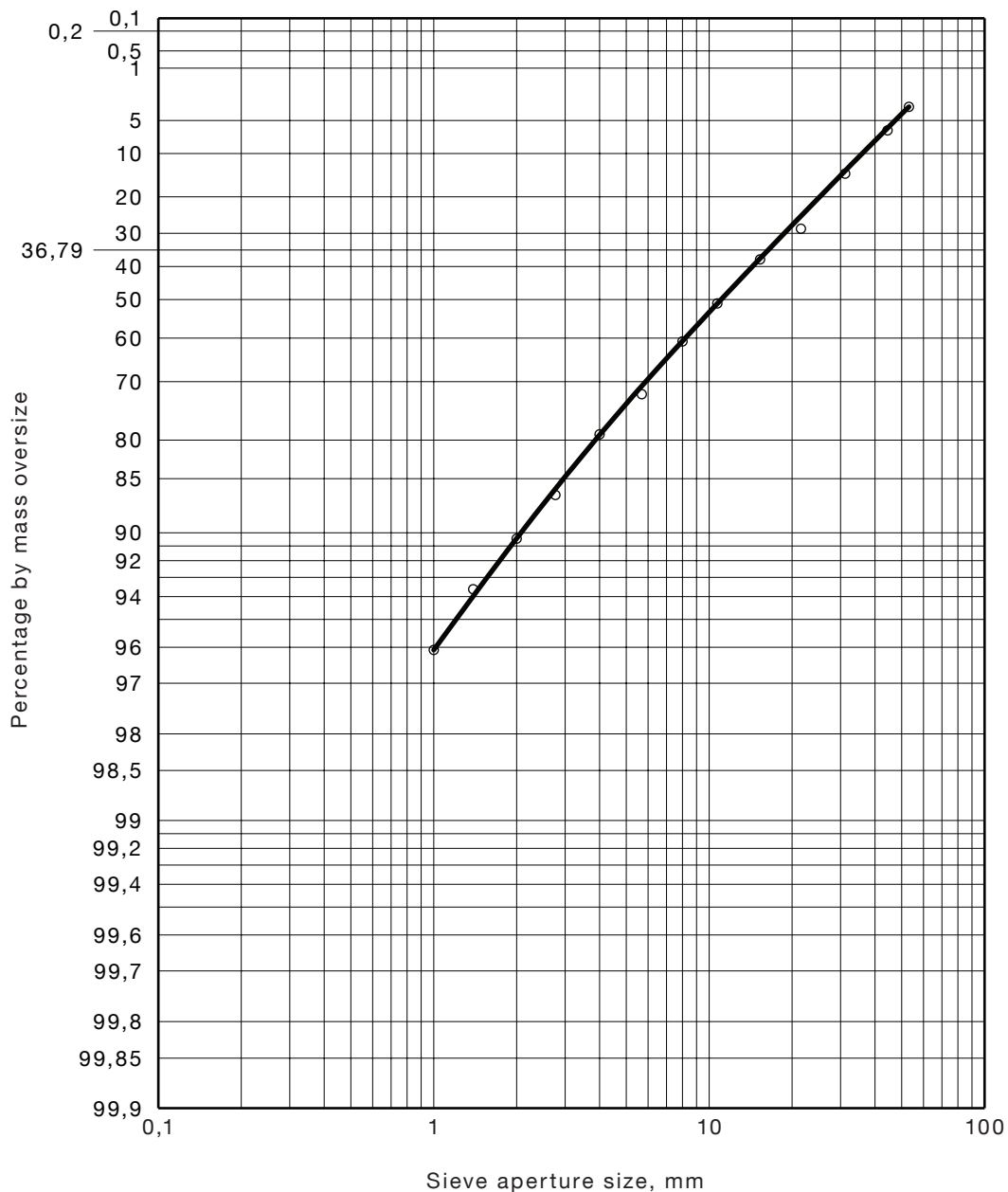


Figure 2 — Rosin Rammler graphical presentation of a size analysis

Annex A **(informative)**

Guide to sampling

A.1 General

In order to simulate screening in coal preparation plants, sizing of plant samples or exploration samples may require use of a sieve fitted with screening apertures similar to types used in coal preparation. For example, stainless steel wedge wire screens. Laboratory sieves may be fabricated using the same type of material used in the plant screens. These sieves may then be used in conjunction with standard sieves. However, it should be noted that these fabricated sieves are not standard sieves and this fact needs to be documented clearly when reporting the data.

A.2 Handling and transport of samples

Since the size distribution of coal changes during conveying, screening and loading, it is important to take the sample at the point in the operations at which the size analysis is required. If the result of the analysis of a sample is to be representative of the size distribution of the lot, it is essential that breakage during the handling and transport of the sample be minimized. Increments shall be placed gently in rigid containers and the handling of these containers during transport shall be as gentle as possible.

Large coal is particularly susceptible to breakage and the methods employed for transporting and sieving the sample will have a marked influence on the size analysis. The bias due to breakage can be reduced by grading the larger pieces, having a particle size greater than 45 mm, at or near the point of sampling by the method described in 7.2.1.

Annex B (informative)

Example of removal by wet sieving of fine material from a sample having a maximum particle size less than 4 mm

Disperse the sample in about 400 ml of water in a suitable vessel (for example, a beaker), making sure that the sample is thoroughly wetted.

- a) Support the smallest aperture size sieve in the set (4.1.1) on a suitable receiver (for example, a large beaker).
- b) Pour the dispersed sample onto the sieve and wash any residue in the vessel onto the sieve with clean water.
- c) Thoroughly wash the material on the sieve with a jet of water while tapping the sieve frame with a piece of wood.
- d) Check whether all the fines have been washed through the sieve by washing the material with a jet of water over a second receiver and examining the washings closely for evidence of solids still being washed out of the sample.
- e) If any solids are present, add them to the first receiver and continue the washings until all the fines have been washed through.
- f) Carefully place the sieve and its contents on a tray (4.1.4) and dry in the oven (4.3.4) controlled at a temperature of 40 °C. When dry, invert the sieve over the tray and clean.
- g) Add a flocculating agent (see Note 2) to the washings containing the undersize material from the wet sieving and allow the solids to settle. Filter, dry and weigh the fine material.

NOTE 1 It is usually necessary to use a small amount of wetting agent.

NOTE 2 If froth flotation is to be carried out after sizing the use of flocculating agent is not advisable.

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